Food Preservation

Public Health
Apprentice Course

Overview

- Purpose of Food Preservation
- Refrigeration and Freezing
- Heat Processing
- Traditional Processes
- Reduced Oxygen Packaging
- Additives
- Food Irradiation

Purpose of Food Preservation

Foods are preserved to make them last longer and often preservation gives foods the flavors/colors we expect

- Some preservation methods just inhibit microbe growth
- Some methods kill microorganisms
- Some methods inhibit chemical reactions in foods
- Some methods do all of the above

Food preservation may make a food safer or may just make it last longer

Refrigeration and Freezing as Methods of Preservation

As you've already learned:

- Most pathogen growth is stopped at ≤ 41°F
- A few pathogens grow slowly under refrigeration

Refrigeration also:

- Slows down spoilage microorganism growth
- Slows chemical reactions that can lead to off-flavors

So when do foods freeze?...

Refrigeration and Freezing (cont.)

At what temperature do foods freeze?

- Pure water freezes at 32°F
- But foods aren't pure water, so they freeze at < 32°F
  - For example, meats don't start to freeze until they are less than about 28°F and aren't hard frozen until closer to 0°F

At temperatures < 32°F, no organisms grow

- No pathogen growth, no spoilage organism growth
- And as the freeze gets colder (i.e., even less than 0°F), chemical reactions are inhibited even more
- So freezing allows long term storage without any food safety concerns
  - But eventually chemical reactions will deteriorate the food

Note: Freezing is not method of killing bacteria

Heat Processing

Heat Pasteurization

- Applied to many foods, not just milk
- Pasteurization means killing of the most resistant problematic microbe in the food
- Heat pasteurization procedures depend on the type of food. Examples:
  - Milk: 145°F for 30 min *or* 161°F for 15 sec
  - Liquid egg product: 140°F for 3.5 min
- Standards set by government (such as the Grade A Pasteurized Milk Ordinance for milk)

Heat Processing (cont.)

- **Canning** (known as the "retort process"). This is heating beyond pasteurization, it is *Commercial Sterilization*
  - All microbial pathogens destroyed--including *C. botulinum* spores
  - The retort process is VERY HOT, UNDER PRESSURE
  - But some spoilage organisms (spores) may survive in unique situations
  - Examples: Cans, MRE pouches

MRE Retort Pouch

Tray Pack Can (feeds many people, such as for a field kitchen)

Traditional Processes to Preserve Foods

Dehydration

- Removing water from a food
  - Freeze Drying
  - Dry Heat
- How does this preserve a food?

Smoking

- Mild surface dehydration
  - Can slow growth of microorganisms
- Some chemicals in smoke can kill bacteria, but the killing is not very significant (pathogens can easily survive)

Traditional Processes (cont.)

Fermentation

- Organic acid and other chemical production by bacteria and/or fungi in a food (these are “good” microbes in foods)
  - How does this preserve foods?
  - The weak acids and chemicals produced also help give the foods their characteristic flavors
- What types of foods are fermented?
- May or may not lower the food pH to less than 4.6, but at least lowers it enough to slow spoilage organism growth

Additives

Organic acids

- For some foods, manufacturers add acid directly to the food
- Preserves food similar to fermentation (here we just add acid instead of having bacteria make it)
- Can you think of some examples of organic acids and what foods they’re added to?

Additives (cont.)

Curing agents

- Added to foods to bind free water (i.e., reduce water activity)
  - Salt
  - Sugar
  - Nitrite
- Curing agents also help give foods their characteristic flavors and colors

Reduced Oxygen Packaging

Two types of Reduced Oxygen Packaging (ROP): Vacuum and Modified Atmosphere

Vacuum Packaging

- Oxygen (O_2) is pulled out of the package
- Done with a lot of foods, including meats
- What happens to the color of vacuum packaged fresh meat?

Vacuum Packaging (examples)

Sliced roast beef

Fresh beef tenderloins

Reduced Oxygen Packaging (cont.)

Modified Atmosphere Packaging

- Oxygen is replaced by Nitrogen (N_2) or Carbon Dioxide (CO_2)
- Food manufacturers just blow the N_2 or CO_2 into the food package
  - This flushes the oxygen out of the package
- Also done with many types of foods
  - Examples...

Modified Atmospheres (examples)

Bagged salads

Ground beef (note: the top of this container feels like a “pillow” because of the gas in the package)

Modified Atmospheres (examples)

Fresh pasta

Reduced Oxygen Packaging (cont.)

- Why do manufacturers use ROP on foods and how does it work?
- Why could ROP decrease the safety of these foods?
- So what's especially important for ROP foods?

Food Irradiation

Also known as “cold pasteurization”

- The food does not heat up when being irradiated

Three types of radiation to treat foods:

- Gamma (^{60}Co, ^{137}Cs)
  - Radioactive isotopes, can’t be “turned off”
- X-rays and Electron Beams
  - Both are similar to a doctor’s x-ray machine, no radiation if you just turn the machine off

Food Irradiation (cont.)

What are the effects of food irradiation?

- Kills insects, inhibits sprouting, kills trichina worms
- With slightly higher irradiation levels, vegetative bacterial cells (like *E. coli*, *Salmonella*, etc.) are also killed
- At the highest approved irradiation levels, it is similar to commercial sterilization of the food (like the retort process)
- Does not make food radioactive!!
- Effect on foods--minimal
- Also destroys spoilage microbes--increases shelf life

Food Irradiation (cont.)

Approved by the government for many foods:

- FF&V, Poultry, and Red Meats (at low to medium doses)
- Spices, Astronaut food (at high doses)

Food Irradiation (cont.)

- Cost: Few cents per pound for meats
- Acceptance: As the food safety experts on base, public health personnel must be able to explain the safety of food irradiation
- Why irradiate foods?

Radura Symbol

- Must have this symbol and be labeled “Treated by Irradiation” or “Treated with radiation”

- Can also add specific statements like

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